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SAMPLING AND ANALYSIS PLAN AND FUNDAMENTAL QUALITY ASSURANCE PROJECT PLAN

RACER PROPERTY AT THE FORMER GMPT SITE, BAY CITY, MI

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TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

LIST OF TABLES
(Following Text)

LIST OF APPENDICES

1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) is pleased to submit this Sampling and Analysis Plan and Fundamental Quality Assurance Project Plan (SAP) to Revitalizing Auto Communities Environmental Response (RACER) Trust to conduct a characterization study of stormwater and groundwater for the Former GMPT Bay City Plant Machine Storage Area (MSA) and Crotty Street Channel (CSC) areas (Site) in Bay City, Michigan.

As a result of the General Motors Corporation (GMC) bankruptcy in 2009, this GMPT Bay City Plant property is being/has been split. RACER now owns the CSC and MSA and General Motors LLC (GM LLC) owns the remainder of the Site. Therefore, the existing remediation system must also be split thus requiring RACER to pursue independent stormwater and groundwater treatment and discharges and corresponding permitting, to the extent required. The purpose of this SAP is to generate the appropriate information to develop an appropriate solution to manage stormwater and groundwater from the RACER property independent of the GM LLC system.

1.1 PURPOSE AND ORGANIZATION OF PLAN

The purpose of the SAP is to present the protocols for a characterization study of stormwater and groundwater at the Site. The characterization study is required to gain a more thorough understanding of the quantity and quality of stormwater and groundwater on the Site for the purpose of determining the best approach to manage the water for discharge to the Saginaw River. The SAP is organized as follows:

Section 1.0 - Presents a general introduction to the Site and the purpose and organization of the SAP

Section 2.0 - Presents a description of the sampling and analysis activities required to characterize the stormwater and groundwater

Section 3.0 - Presents a description of the activities required to quantify the groundwater flow from the Site

Section 4.0 - Presents a description of the sample collection procedures and equipment decontamination procedures

Section 5.0 - Presents a description of the procedures used to determine groundwater and stormwater flow from the Site

Section 6.0 - Presents a description of sample handling, documentation and shipment

Section 7.0	-	Presents a description of the analytical methods and quality assurance/quality control (QA/QC) procedures for the characterization study
Section 8.0	-	Presents a description of the project schedule
Section 9.0	-	Presents a description of the reporting that will be completed following the analysis of collected samples

This SAP contains the specific technical approaches to collect data of sufficient quantity and quality to develop appropriate alternatives for the treatment of groundwater and management of stormwater as well as completing the necessary permit applications for the discharge of water.

1.2 BACKGROUND

Under a 1992 Consent Judgment, GMC built a stormwater/non-contact cooling water treatment system to eliminate PCB discharges to the Saginaw River. The treatment system treats all stormwater, non-contact cooling water and extracted groundwater on the approximately 116-acre property. The system consists of equalization in two lagoons, followed by multi-media (sand) filtration followed by granular activated carbon (GAC) adsorption. The system was designed to handle the 10-year 24-hour storm (3.5 inches) event across the 116-acre Site. The system is capable of treating at 4,000 gallons per minute (gpm) and can store 2,080 gpm in the lagoons to achieve the design limits. The system operates as a closed loop therefore only excess water is discharged to the river. The stormwater/non-contact cooling water treatment system has been operating since May of 1993.

A Remedial Investigation (RI)/Feasibility Study (FS)/Remedial Action Plan (RAP) was completed covering the entire 116 acre property. In 1998, the RAP was revised and resubmitted to the MDEQ. The CSC, northwest of the Site and not subject to the 1992 Consent Judgment, was investigated voluntarily by GMC. GMC owned half the CSC channel while CSX owned the other half. GMC acquired CSX's half of the channel and proposed a containment RAP to the MDEQ in 1999. The two RAPs were combined. The remedy was constructed in 1999 and 2000, and included a multi-layer cap (from bottom up, 6 inches bedding sand, 40-mil HDPE textured liner, drainage net, 1 foot of grading fill, 6 inches of topsoil, and grass). In addition, groundwater extraction systems were installed in 3 areas, CSC (3.3 acres), the former MSA (6.8 acres), and the Lagoon Area (LA). The extracted groundwater is routed to the storm sewer system for treatment in the stormwater/non-contact cooling water treatment system. Groundwater is extracted from the fill unit above the intermediate confining unit. The CSC groundwater extraction system consists of three extraction manholes with air lift extraction pumps. In addition, a sump pump was installed in the middle extraction manhole (EW-14). The sump pump operating using floats is installed at the bottom of the manhole and performs the primary extraction from the CSC due to the transmissive nature of the fill used to backfill the channel and effectively dewaters the CSC. The MSA groundwater extraction system consists of seven extraction wells with air lift extraction pumps. The pump in each extraction well is installed at the bottom of the well to maximize drawdown. It is important to note that due to the variable nature of the fill material in the MSA, dewatering is evaluated using the extraction well water levels. The MSA and LA areas are horizontally contained with slurry walls/deep mixing zone walls installed in 1987/1988. As part of the RAP, the CSC was contained with a sheet pile wall that ties into the slurry wall/deep mixing zone wall adjacent to the MSA. The goal of the extraction systems is to maintain an inward gradient across the containment walls. The surface water from the cap is routed to the storm sewer system for treatment in the stormwater/non-contact cooling water treatment plant.

Since the remedy installation, O&M activities have been ongoing. The majority of the O&M effort is spent cleaning as a result of iron bacteria fouling the pumps and forcemains of the groundwater extraction systems. In 2008, a pilot study was completed to evaluate alternatives to manage the iron bacteria. The result of the study indicated some surfactants may work but the cost savings were not significant.

As a result of the GMC bankruptcy, this Site is being/has been split. RACER now owns the CSC and MSA and General Motors LLC (GM LLC) owns the remainder of the Site. The most cost effective solution is to continue to manage and discharge water using the current system with RACER compensating GM LLC for the treatment/management, however, due to the property split, the remedy must now also be split thus requiring RACER to pursue independent stormwater and groundwater treatment and discharges and corresponding permitting, to the extent required. The purpose of this SAP is to generate the appropriate information to develop an appropriate solution to manage stormwater and groundwater from the RACER property independent of the GM LLC system.

2.0 QUALITY CHARACTERIZATION

2.1 GROUNDWATER CHARACTERIZATION

Groundwater will be sampled from eight extraction wells throughout the Site, as presented on Figure 2.1 and analyzed for Site-specific volatile organic compounds (SS-VOC). Monitoring and extraction well details are presented in Table 2.1. In addition, extraction well EW-14 and three groups comprised of the seven extractions wells in the MSA will be composited into three samples and analyzed for Site-specific-semi-volatile organic compounds (SS-SVOC), polychlorinated biphenyls (PCB), target analyte list (TAL) metals (including low level mercury [LLHg] if needed and excluding potassium), polychlorinated dibenzodioxins/polychlorinated dibenzofurans (PCDD/PCDF), oil and grease as hexane extractable material (HEM), total and dissolved iron, total iron bacteria, and other inorganics including alkalinity, ammonia-N, biochemical oxygen demand (BOD), chemical oxygen demand (COD), hardness, total dissolved solids (TDS), total organic carbon (TOC), total suspended solids (TSS), and total phosphorus. The samples will be composited at the laboratory. In addition to the laboratory parameters pH, temperature, conductivity, turbidity, and dissolved oxygen (DO) will be determined in the field during groundwater sampling. The samples will be analyzed as composites which will be prepared at the laboratory. The extraction wells in the MSA will be grouped for compositing as follows: EW-6, EW-10, and EW-12 as they are the highest water producing extraction wells in the MSA; EW-8 and EW-11 due to the periodic presence of product; and EW-7 and EW-9. All samples will be collected using low flow sampling procedures.

Additionally, samples will also be collected from extraction wells EW-7, EW-10, and EW-14 using the existing extraction pumps and analyzed for DO, pH, total and total dissolved iron and total iron bacteria. These samples will provide a comparison to determine the significance of the pump operation (peristaltic vs. air lift) on biofouling as the introduction of air into the water by the extraction pumps may exacerbate the biofouling.

Three additional samples will be collected from monitoring wells MW-1S, MW-100S, and MW-300S and analyzed for DO, pH, total and total dissolved iron and total iron bacteria.

A complete list of all analytical parameters by sample matrix is presented in Table 2.2 and the sampling methodology for groundwater is presented in Section 4.1. The results will be screened against the Rule 57 Surface Water Criteria to determine if the groundwater is of sufficient quality to discharge to the Saginaw River or if it requires treatment.

2.2 STORMWATER CHARACTERIZATION

The stormwater from the MSA and CSC areas will be characterized to support a permit to discharge the water to the Saginaw River. Stormwater samples will be collected from Catchbasin 2 (CB-2), as identified on Figure 2.1, and analyzed for: SS-VOCs, SS-SVOCs, PCBs, TAL Metals (including LLHg if needed and excluding potassium), PCDDs/PCDFs, HEM, and other inorganics including alkalinity, ammonia-N, BOD, COD, hardness, TDS, TOC, TSS, and total phosphorus. In addition to the laboratory parameters pH and temperature will be determined in the field during sample collection. A complete list of the parameters by sample matrix is presented in Table 2.2. The parameters were selected to provide a comprehensive characterization of the stormwater on the Site. Samples will be collected during storm events to ensure they are representative stormwater flows. Samples will be collected during two separate storm events to allow for comparison. The results of this sampling will be sufficient to characterize the stormwater collected on the Site. The results will be screened against the Rule 57 Surface Water Criteria to determine if the stormwater is of sufficient quality to discharge to the Saginaw River.

2.3 SURFACE WATER CHARACTERIZATION

Surface water samples will be collected from the Saginaw River to provide background or reference concentrations in the river for comparison to the Site data. Two representative river water samples will be collected from the middle of the river, the first approximately 100 feet upstream of the Site and the second approximately 200 feet upstream of the Site. The approximate locations of the surface water samples are presented on Figure 2.2. The samples will be analyzed for SS-VOCs, SS-SVOC, PCB, TAL metals (including LLHg if needed and excluding potassium), PCDDs/PCDFs, HEM, and other inorganics including alkalinity, ammonia-N, BOD, COD, hardness, TDS, TOC, TSS, and total phosphorus. In addition to the laboratory parameters pH and temperature will be determined in the field during sample collection. A complete list of the analytical parameters is presented in Table 2.2. The results will be screened against the Rule 57 Surface Water Criteria to determine the quality of surface water in the Saginaw River for relative comparison to the Site stormwater and groundwater.

2.4 TREATABILITY TESTING

Following completion of the groundwater and surface water characterization as identified above, the data will be evaluated to determine whether treatment is required to meet surface water discharge criteria. If treatment is required, representative samples of water will be collected and shipped to a treatability laboratory for bench scales testing of treatment technologies. The results will be presented in the report discussed in Section 9.0.

3.0 QUANTITY CHARACTERIZATION

3.1 GROUNDWATER QUANTITY

In order to determine the appropriate sizing/capacity for a new system, the amount of groundwater flow to the existing CSC and MSA extraction systems will be evaluated/confirmed.

For the CSC extraction system flow evaluation, an evaluation of flow at extraction well EW-14 will be conducted. A mechanical flow meter with totalizer will be installed at the EW-14 discharge. Due to the properties of the material used to infill the CSC during containment, the hydraulic communication in this section is sufficiently high to allow for representative pumping from one centrally located extraction well. In reviewing data recorded for the CSC, flow will be characterized by adjusting the floats in the EW-14 to a level closer to that of the river while continuing to ensure and inward gradient yet reduce the amount of water to be extracted. During this process the water levels at all extraction wells and monitoring wells within the CSC will be recorded over time. The discharge flow (instantaneous and total) at EW-14 will be monitored at least daily on an ongoing basis during the study. The water levels and flow readings will be collected until the groundwater levels appear stable. The data will be used to determine the optimum depth to maintain the water level in EW-14 in order to maintain an inward gradient. The specific procedures for monitoring the water elevations is presented in Section 5.1.

For the MSA extraction system flow evaluation, system operation at all seven extraction wells will be conducted. A mechanical flow meter with totalizer will be installed at the discharge of the MSA system. The MSA flow will be characterized by adjusting the floats in the extraction wells to a level closer to that of the river while continuing to ensure and inward gradient yet reduce the amount of water to be extracted. During this process the water levels at all extraction wells and monitoring wells within the MSA will be recorded over time. The discharge flow (instantaneous and total) from the MSA system will be monitored at least daily on an ongoing basis during the study. The water levels and flow readings will be collected until the groundwater levels appear stable. The data will be used to determine the optimum depth to maintain the water level in each extraction well in order to maintain an inward gradient. The specific procedures for monitoring the water elevations are presented in Section 5.1.

3.2 STORMWATER QUANTITY

Consistent with standard storm sewer design, the quantity of stormwater will be calculated to determine the size of the piping required to convey it to the river under gravity. This will be completed using rainfall intensity information for a design storm event combined with expected runoff resulting from the type of surface.

4.0 SAMPLE COLLECTION PROCEDURES

The following sections detail the sampling procedures.

4.1 GROUNDWATER SAMPLING

Groundwater samples will be collected from extraction wells using the procedures specified below:

1. A new pair of disposable nitrile gloves (or equivalent) will be donned at each location.
2. Measure the depth to water in each well to the nearest 0.01 foot using a pre-cleaned electronic depth-to-water water probe. Well depth should be obtained from the well log and confirmed with the water probe. Well depths can be found in Table 2.1.
3. Purging will be conducted using a pre-cleaned peristaltic or Grundfos® submersible pump. Each pump will be fitted with a sufficient length of tubing dedicated to the well. For non-dedicated pumps, lower the pump so that the pump intake corresponds to the approximate middle of the well screen.
4. Purge the extraction well at a pumping rate of between 0.25 and 1.5 gpm.
5. Measure water field parameters pH, temperature, dissolved oxygen (DO), conductivity and turbidity approximately every 5 minutes using a field water quality meter (e.g., Horiba).
6. Continue purging until stabilization is achieved. Stabilization is achieved after all parameters have stabilized for three consecutive readings and are within the following limits:
   - pH ±0.2 pH units of the median value of the three readings
   - Conductivity ±10 percent of the median value of the three readings
   - Temperature ±10 percent of the median value of the three readings
   - DO ±10 percent of the median value of the three readings
7. If stabilization is not achieved after 3-well volumes, the purging and recording of field parameters will continue to a maximum of 5-well volumes.
8. Collect groundwater through the tubing directly into laboratory-supplied containers in order of decreasing analyte volatility using techniques that minimize sample agitation.
9. In the event that the groundwater recharge to the monitoring well is insufficient and the well will be pumped to dryness, groundwater will be allowed to recover to a level sufficient for sample collection. Upon recovery, groundwater samples will be collected as described in Item 7.

4.2 STORMWATER SAMPLING

Stormwater samples will be collected from Catchbasin 2 during two separate rainfall events, using the procedures specified below:

1. A new pair of disposable nitrile gloves (or equivalent) will be donned at each location.
2. Pumping will be conducted using a pre-cleaned peristaltic or Grundfos® submersible pump. Lower the pump so that the pump intake corresponds to the approximate middle of the water column.
3. Collect stormwater through the tubing directly into laboratory-supplied containers in order of decreasing analyte volatility using techniques that minimize sample agitation.
4. Measure water field parameters pH, temperature, dissolved oxygen (DO), conductivity and turbidity during sampling using a field water quality meter (e.g., Horiba).
5. In the event that the stormwater recharge to the catch basin is insufficient and the basin will be pumped to dryness, the samples should be collected during a heavier rainfall event.

4.3 SURFACE WATER SAMPLING

Surface water samples will be collected from the Saginaw River, using the procedures specified below:

Surface water samples will be collected from the locations identified on Figure 2.2 using the procedure specified below.

1. A new pair of disposable nitrile gloves (or equivalent) will be donned for each set of samples collected at each location
2. The surface samples will be collected by submerging one of the large sampling bottles (without preservatives) and filling the laboratory supplied containers in order of decreasing analyte volatility using techniques that minimize sample agitation
3. Measure water field parameters pH, temperature, dissolved oxygen (DO), conductivity and turbidity during sampling using a field water quality meter (e.g., Horiba).

5.0 GROUNDWATER FLOW ANALYSIS PROCEDURES

The following sections detail the groundwater flow quantity evaluation procedures.

5.1 GROUNDWATER FLOW ANALYSIS

A Pumping Test is a common method for determining aquifer hydraulic parameters (transmissivity, storativity/specific yield). The general principle of pumping tests is that by pumping a well and measuring the discharge rate, along with the drawdown in the well and the surrounding wells/piezometers at known distances, we can apply these measurements to appropriate analytical solutions to determine the hydraulic characteristics of the aquifer.

The pumping test to be performed in the CSC and MSA will be performed in the following order.

1. Float Relocation/Pump Relocation
2. Recovery test water level monitoring
3. Discharge flow monitoring (instantaneous and total)

5.1.1 DISCHARGE RATE MEASUREMENT

Measurement of the discharge or flow rate is common to both the step-drawdown test and the constant-rate pumping test. Any significant variation of the flow rate produces aberrations in the drawdown data that may complicate the aquifer analysis. Discharge flow rates will be monitored using a mechanical flow meter installed at the discharge of extraction well EW-14 and at the discharge of the MSA system. The flow meter will provide and instantaneous flow reading and will have a flow totalizer. The flow will be recorded at least daily and will include the instantaneous and total flow as well as the time recorded. Discharge rate measurements are recorded on Form SP-20 Appendix A or in the field book.

5.1.2 WATER LEVEL MEASUREMENTS

Water level measurements are required prior to the test, during the test, and following the test. The monitoring wells used during the test are presented on Figure 2.1. Furthermore, staff gage (SG-1) will be repaired or replaced and monitored to allow for comparison between the Saginaw River water level and water level in the wells to evaluate gradients.

The time of day at which a water level is measured manually is to be recorded (this need not be strictly the same time for all wells). If more than one person is conducting water level measurements, all watches must be synchronized.

5.1.3 FLOAT/EXTRACTION WELL PUMP RELOCATION

EW-14 currently uses a float system to control the water level within the extraction well. Similarly, the extraction pumps control water level within the extraction wells. Based on data review it is believed that the existing floats at EW-14 are set at a much lower depth than required to maintain an inward gradient. As such the floats at EW-14 will be raised to 576 feet above mean sea level (ft AMSL) for the pump off and 576.5 ft AMSL for the pump on. For five QED model SP2000 pumps in the MSA, the pump elevation will be adjusted so the top of the pump is at 576 ft AMSL which ensures that the pump operates with a groundwater water elevation of 576 ft AMSL within the well. For the two QED model AP3B pumps in the MSA, the top of the pump will be set at 577 ft AMSL and will operate with a water elevation of 576 m AMSL. This depth may be raised or lowered depending on the progression of the testing. This depth has been selected to provide an inward gradient from the average water level of the Saginaw River which ranges from 577 to 577.5 ft AMSL. A record of the average water levels in the Saginaw River is presented on Figure 5.1.

5.1.4 TEST PROCEDURE

The test is conducted at a discharge rate determined to maintain water level based on the adjustments. The test will continue for 4 days or until water levels at extraction wells and monitoring wells are reasonably stable. The procedure is as follows:

1. Collect pre-test monitoring levels at all locations.
2. Install mechanical flow meters with totalizers at EW-14 discharge and MSA system discharge.
3. Once the floats/pumps are adjusted, monitor the water levels until reasonably stable.

4. Record all manual water level measurements on the appropriate field form, Pumping Test - Drawdown Data, Appendix A. In addition, record the discharge flow rate both instantaneous and total.
5. Monitor Saginaw River water levels at approximately 12-hour intervals during the test.
6. Note water quality observations detailing clarity (i.e., Clear, cloudy, opaque), turbidity, pH, specific conductivity, odor, or any other observation.
7. Once the monitoring wells/extraction wells reach steady state the groundwater elevations should be check against the reference Saginaw River elevation. Adjust extraction well pumps as necessary to maintain an inward gradient.

5.1.5 FOLLOW-UP ACTIVITIES

At the completion of testing field activities:

1. Verify that all manually recorded data is present and accurate. Notify the Project Manager immediately if there are data problems.
2. Decontaminate equipment according to Section 7.2. All equipment decontamination will occur at the Site upon completion of all activities, then be returned to the field equipment manager. Note any equipment which requires maintenance or service.
3. Notify the contract laboratory of the water samples collected during the test.
4. Secure wells and return keys to the key box.

6.0 SAMPLE HANDLING AND DOCUMENTATION

Sample handling procedures (including container, preservation, holding time, packaging, and shipping requirements), and field documentation requirements are provided in the following subsections. A summary of the groundwater and stormwater characterization study is presented in Table 2.2.

6.1 SAMPLE HANDLING

Laboratory-supplied, pre-cleaned sample containers will be used to collect all samples. Sample containers, preservation, holding time periods, packaging, and shipping requirements are presented in Table 6.1. All samples will be identified using a unique sample identification number. The sample numbering system has been designed to uniquely identify every sample from each sampling program and event. This numbering system consists of the sample matrix code, sample collection date, initials of sampler, and sequential number beginning with 001 for each sampling event.

An example of the sample numbering system follows:

MC-12610-mmddyy-XX-001

Where:

MC (Matrix Code)	=	WM – Stormwater/GW – Groundwater/SW – Surface Water
12610	=	CRA Project Number
mm/dd/yy	=	Date in month/day/year
XX	=	Samplers first and last initials
001	=	Sequential number for event

Field quality control (QC) samples that will be collected during the project include equipment blank, field duplicate, trip blank, and matrix spike/matrix spike duplicate (MS/MSD) samples. Equipment blank and field duplicate samples will be submitted blindly to the laboratory and will be identified using the sample numbering system identified above. Samples designated for MS/MSD analysis will be identified as such in the remarks column of the chain-of-custody form.

Samples will be placed in shipping coolers containing bagged, cubed ice following collection. The samples will be shipped to the laboratory via an overnight courier service, generally on the day they are collected or the next business day.

6.2 FIELD DOCUMENTATION

6.2.1 FIELD LOGBOOKS

Logbooks will be used to record field data collection activities. Entries into field logbooks will be described in as much detail as possible to ensure that a particular situation could be reconstructed solely from logbook entries. Field logbooks will be bound field survey books or notebooks with consecutively numbered pages.

The title page of each logbook will contain the following information:

1. Person to whom or task for which the logbook is assigned
2. Project number
3. Project name
4. The starting date for entries into the logbook
5. The ending date for entries into the logbook

Entries into the logbook will contain a variety of information. At the beginning of each day's logbook entry the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be entered. The names of individuals visiting the site or field sampling team and the purpose of their visit will also be recorded in the field logbook.

All field measurements obtained and samples collected will be recorded. All logbook entries will be made in ink, signed, and dated with no erasures. If an incorrect logbook entry is made, the incorrect information will be crossed out with a single strike mark that is initialed and dated by the person making the erroneous entry. The correct information will be entered into the logbook adjacent to the original entry.

Whenever a sample is collected or a measurement is made, a detailed description of the location will be recorded in the logbook. Photographs taken at a location, if any, will also be noted in the logbook. All equipment used to obtain field measurements will be recorded in the field logbook. In addition, the calibration data for all field measurement equipment will be recorded in the field logbook or on standard field forms.

Samples will be collected following the sampling procedures described in Section 4.0. The equipment used to collect samples, date and time of sample collection, and sample description/location will be recorded in the field logbook. Each sample will be uniquely identified using the sample numbering system described in Section 6.1.

6.2.2 SAMPLE CUSTODY PROCEDURES

Chain of custody is the sequence of possession of an item. An item (such as a sample) is considered to be in custody if the item is in actual possession of a person, the item is in the view of the person after being in his/her actual possession, or the item was in a person's physical possession but was placed in a secure area by that person.

The sample packaging and shipping procedures summarized below will ensure that the samples arrive at the laboratory with the chain of custody intact:

1. The field sampler is personally responsible for the care and custody of the samples until they are transferred to another person or the laboratory. As few people as possible will handle the samples.
2. All sample containers will be identified by using sample labels that include the date of collection, unique sample number, and analyses to be performed.
3. Sample labels will be completed for each sample using waterproof ink.
4. Samples will be placed in coolers containing ice after collection.
5. Samples will be accompanied by a properly completed chain-of-custody form. An example chain-of-custody form is provided in Appendix B. The sample identification numbers will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign and record the date and time on the form. The chain-of-custody form documents sample custody transfers from the sampler to another person, to the laboratory, or to/from a secure storage area.
6. All sample shipments will be accompanied by the chain-of-custody form identifying its contents. The chain-of-custody form is a four-part carbonless-copy form. The form is completed by the sampling team, which, after signing and relinquishing custody to the shipper, retains the bottom (goldenrod) copy. The shipper, if different than the sampling team members, retains the pink copy after relinquishing custody to the laboratory. The yellow copy is retained by the laboratory. The fully executed top (white) copy is returned as part of the data deliverables package.
7. Samples will be properly packaged for shipment (see Table 6.1) and dispatched to the project laboratory for analysis with a separate signed chain-of-custody

form enclosed in each shipping cooler. Shipping coolers will be secured with custody tape for shipment to the laboratory. The custody tape is then covered with clear plastic tape to prevent accidental damage to the custody tape.

8. If the samples are sent by common carrier, a bill of lading will be used and copies will be retained as permanent documentation. Commercial carriers are not required to sign the chain-of-custody form as long as the form is sealed inside the sample cooler and the custody tape remains intact.

9. If samples are not shipped to the laboratory the same day the samples are collected in the field, additional ice will be placed in the coolers, the coolers will be sealed and kept in a designated secure area until they are shipped to the laboratory as described above.

7.0 ANALYTICAL METHODS AND QUALITY CONTROL SAMPLES

TestAmerica will be the primary laboratory supporting the environmental sample analysis for this project utilizing their facilities in North Canton, Ohio (TA-NC) and West Sacramento, California (TA-WS) for the analysis of SS-VOCs, SS-SVOCs, PCBs, TAL Metals (including LLHg if needed and excluding potassium), PCDDs/PCDFs, HEM, and other inorganics including alkalinity, ammonia-N, BOD, COD, hardness, TDS, TOC, and total phosphorus. Sample analysis for total iron bacteria will be performed at the CRA office in Niagara Falls, New York.

7.1 LABORATORY ANALYTICAL METHODS

Stormwater, surface water, and groundwater samples will be analyzed for specified chemical constituents off Site by the project laboratory. The methods that will be used for sample analysis are presented in Table 7.1. Specific analytes and targeted quantitation limits for chemical constituents are presented in Table 7.2.

7.2 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

7.2.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Field QA/QC requirements for field-portable instruments include analyzing reference standards for instrument calibration and for routine calibration checks. Field QC samples collected during field sampling include equipment blank samples to determine the existence and magnitude of sample contamination resulting from ambient conditions or sampling procedures, and field duplicate samples to assess the overall precision of the sampling and analysis events. Additionally, stormwater, surface water, and groundwater samples will be designated as MS/MSD samples for assessment of laboratory QC procedures. Laboratory supplied trip blank samples will be included in each shipping cooler for the analysis of VOCs and mercury. The specific QC samples and collection frequency are summarized in Table 2.2.

Equipment blank samples will be collected at a frequency of 1 per 20 or fewer sampling equipment decontamination procedures. Equipment blank samples will be collected by routing laboratory-provided deionized water through decontaminated sampling equipment. Equipment blank samples will be analyzed to check procedural contamination and/or ambient conditions and/or sample container contamination at the Site that may cause sample contamination. Equipment/Field blank samples will not be required for samples collected using pre-cleaned or pre-cleaned, disposable sampling equipment.

Field duplicate samples collected at a minimum frequency of 1 per 20 investigative samples. Field duplicate samples will be analyzed to assess the precision of the field sample collection procedures.

Trip blank samples, consisting of VOC-free or mercury free water poured into sample vials at the laboratory, will be provided by the project laboratory for the groundwater sampling events. Trip blank samples will be handled in a manner consistent with actual field samples, but will not be opened, and will be shipped back to the laboratory with the samples. Trip blank samples will provide an indication of potential cross-contamination of samples by VOCs and/or mercury during shipment and handling. One trip blank sample will be included in each shipping cooler containing aqueous samples for VOC or mercury analysis.

Additional sample volume will be provided to the laboratory (as necessary) for MS/MSD analyses. The data from MS/MSD analyses provide an indication of the precision and accuracy of the analytical method relative to the sample matrix. Samples for MS/MSD analysis will be designated at a minimum frequency of 1 per 20 or fewer samples.

7.2.2 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Laboratory QC requirements for the analysis of stormwater, surface water, and groundwater samples analyzed for the organics, metals and inorganics include instrumental performance check standards (mass tuning), initial calibration standards, calibration verification standards, continuing calibration verification standards, internal standards, method blanks, surrogate standards, MS/MSD samples, and laboratory control samples (LCS). The analysis frequency for these QC samples is identified in the applicable laboratory SOP in Table 7.1. The acceptance criteria for these QC checks will be consistent with the analytical methods provided in Table 7.1 and applicable laboratory SOP.

7.2.3 LABORATORY REPORT DELIVERABLES

Laboratory reports for samples collected will consist of the following data deliverables:

1. Case Narrative:
    - i) Date of issuance
    - ii) Project name and number
    - iii) Any deviations from intended analytical strategy
    - iv) Condition of samples "as received"
    - v) Discussion of whether or not sample holding times were met
    - vi) Discussion of technical problems or other observations that may have created analytical difficulties
    - vii) Discussion of any laboratory quality control checks that failed to meet project criteria
2. Chemistry Data Package:
    - i) Dates of sample collection, receipt, preparation, and analysis
    - ii) Cross-reference of laboratory to project sample identification numbers
    - iii) Description of data qualifiers used
    - iv) Methods of sample preparation and analysis
    - v) Sample results in tabular format
    - vi) Method blank data, LCS data, duplicate sample data, MS/MSD data, surrogate compound spike data
    - vii) Fully executed chain-of-custody document

7.2.4 DATA REVIEW AND VALIDATION

Upon receipt of the final data packages from the project laboratory the data will be reviewed and validated. The data review will evaluate the final analytical results, holding time period compliance, equipment blank sample data, field duplicate sample data, method blank data, LCS data, laboratory duplicate data, surrogate compound spike data, and MS/MSD sample data. Validation of the data will consist of evaluating the QA/QC data based on the applicable review criteria specified in "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", dated October 1999 and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", dated February 1994. The results of the data review and validation process will be documented in memoranda that identify all limitations on the usability of the analytical data.

8.0 SCHEDULE

A summary of the proposed schedule for the activities identified in this SAP are presented below:

1. July 5, 2011, initial groundwater quality characterization sampling
2. July 11, 2011, groundwater flow analysis of the CSC and MSA
3. End of August 2011, evaluation of the results will be completed
4. Collect representative groundwater samples for treatability testing in early September
5. Complete treatability testing in October, if required
6. End of November, data report and design analysis will be completed and submitted to MDEQ in a report
7. End of December 2011, NPDES permit applications will be prepared and submitted

As the stormwater quality samples must be taken during a rainfall event the stormwater samples will be collected when available.

9.0 REPORTING

Table 9.1 presents an approximate cost to complete the work identified in this SAP.

A summary report presenting the investigation results, data evaluation, treatability results, and recommendations will be prepared and submitted.

FIGURES

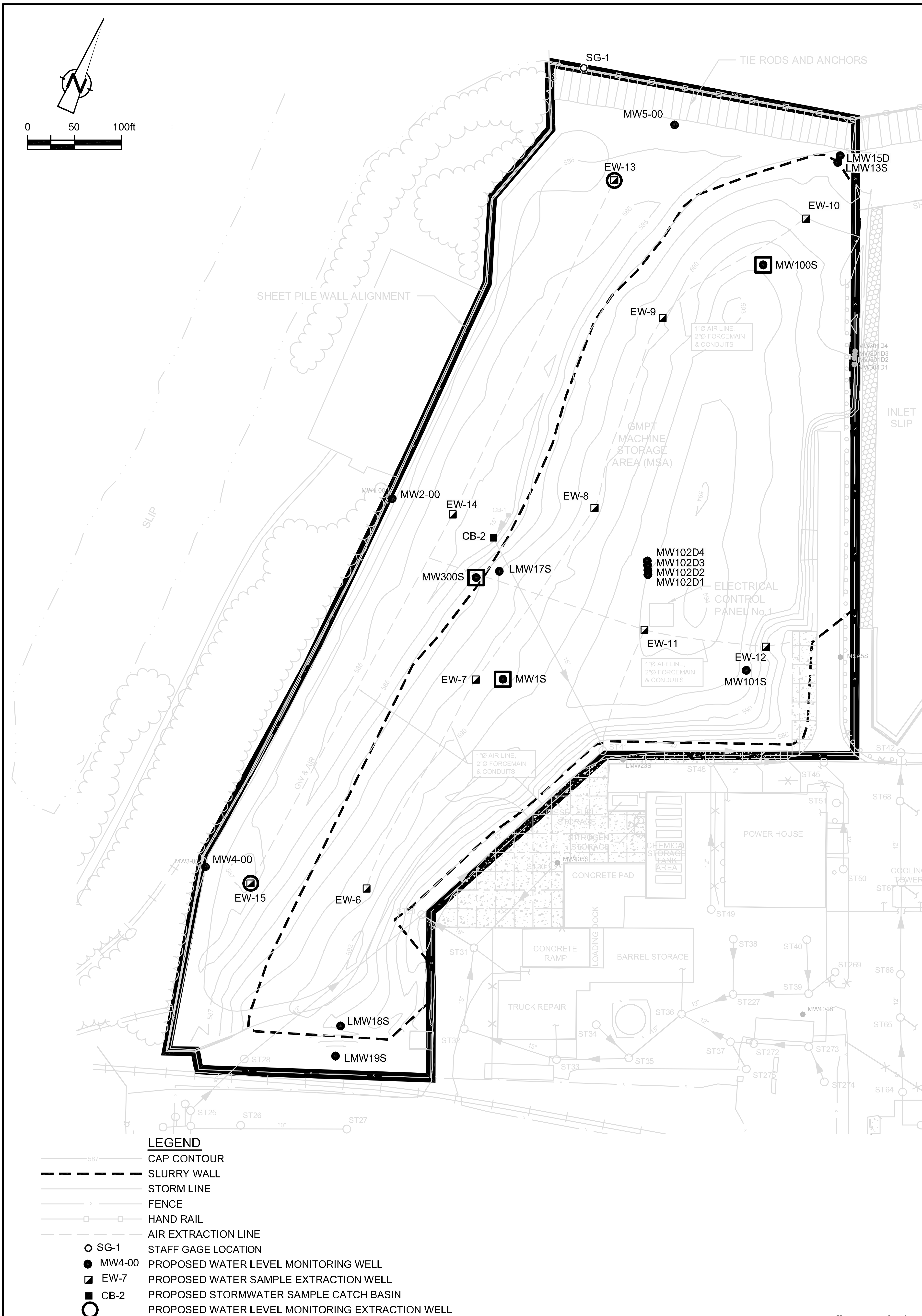
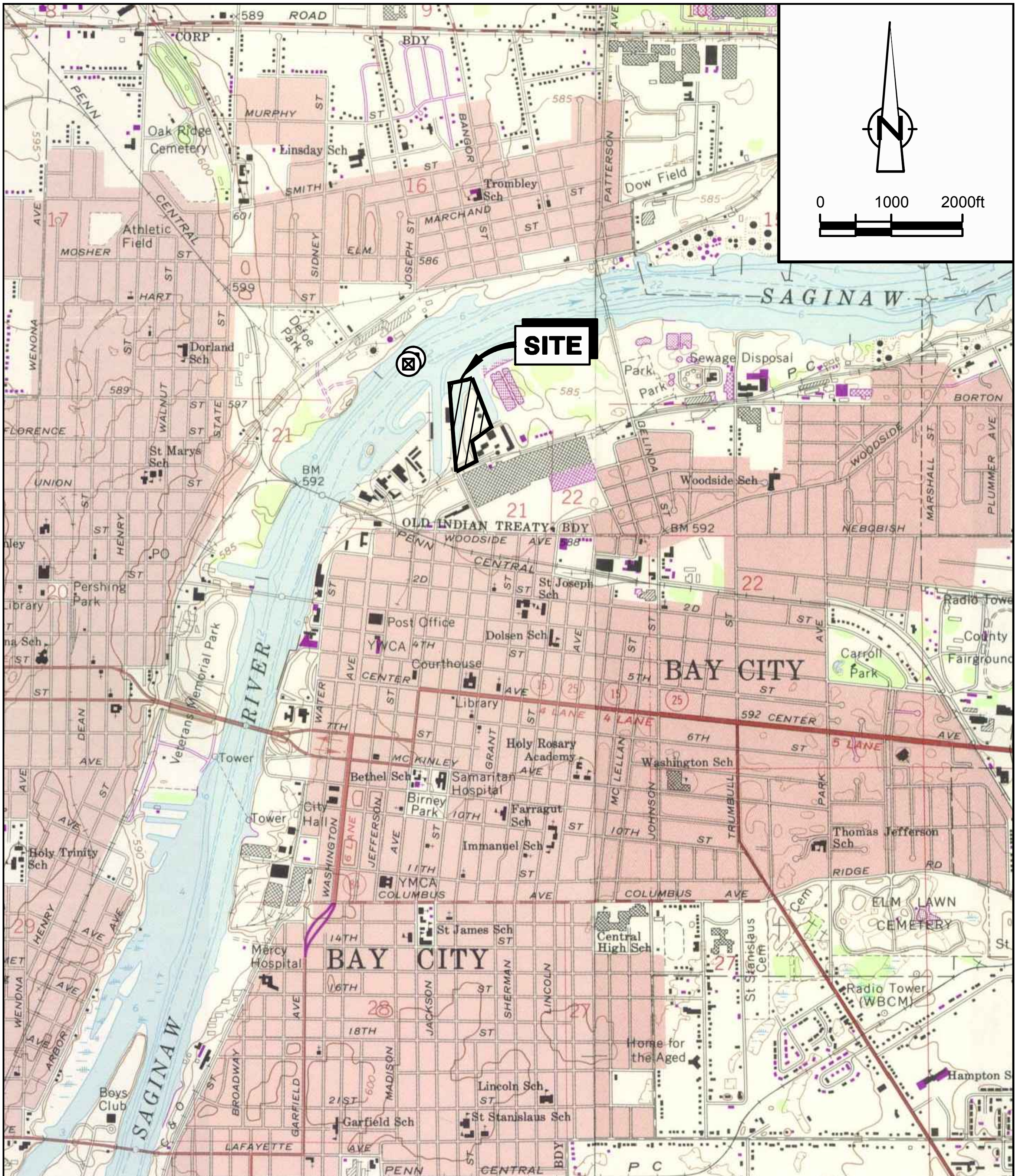


figure 2.1

PROPOSED GROUNDWATER AND STORMWATER SAMPLE LOCATIONS

Bay City, Michigan

12610-T03(020)GN-WA001 JUN 30/2011



SOURCE: U.S.G.S. QUADRANGLE MAPS;
BAY CITY AND ESSEXVILLE, MICHIGAN
1967 (PHOTO REVISED 1973)

LEGEND

⊠ PROPOSED SURFACE WATER SAMPLE LOCATION

figure 2.2

PROPOSED SURFACE WATER SAMPLE LOCATIONS

Bay City, Michigan

CRA

12610-T03(020)GN-WA002 JUL 04/2011

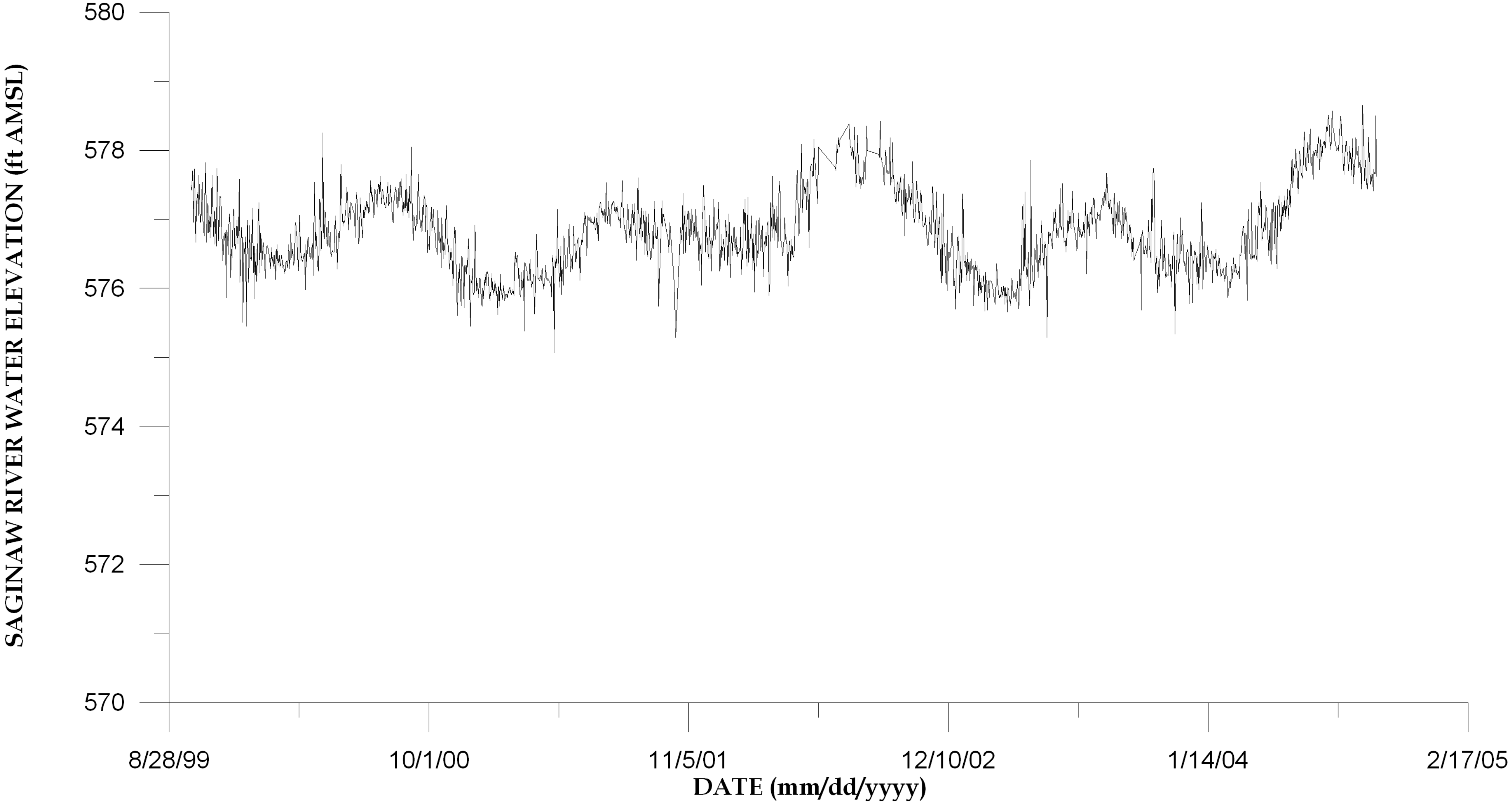


figure 5.1
AVERAGE WATER ELEVATIONS IN THE SAGINAW RIVER
USGS 04157065 SAGINAW RIVER AT WEADOCK ROAD
ESSEXVILLE, MI

TABLES

TABLE 2.1

SUMMARY OF EXTRACTION WELL AND MONITORING WELL COMPLETION DETAILS
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Extraction Well	*Reference Elevation (ft AMSL)*	*Bottom of Well Elevation (ft AMSL)*	*Top ICU (ft AMSL)*
Machine Storage Area			
EW-6	589.74	570.39	572.39
EW-7	587.99	571.14	571.64
EW-8	588.34	572.29	573.29
EW-9	588.04	572.19	573.69
EW-10	587.77	570.82	572.32
EW-11	591.51	571.91	572.56
EW-12	586.42	571.57	573.07
Crotty Street Channel Containment Area			
EW-13	584.33	571.86	NA
EW-14	582.42	569.92	NA
EW-15	583.71	571.61	NA

TABLE 2.1

SUMMARY OF EXTRACTION WELL AND MONITORING WELL COMPLETION DETAILS
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Well Location	*Ground Surface Elevation (feet AMSL)*	*Top of Riser Elevation (ft AMSL)*	*Modified Top of Riser Elevation (ft AMSL)*	*Depth of Well (feet)*	*Screen Length (feet)*	*Screen Type*	*Riser Type*	*Diameter of Screen (inches)*
<u>Machine Storage Area (MSA)</u>								
MW1S	631.5	591.94	591.08	12.95	2	SS	SS	2
MW100S	639.5	590.03	591.97	14.44	10	SS	SS	2
MW300S	639.9	587.71	587.12	15.06	10	SS	SS	2
<u>Crotty Street Channel</u>								
MW2-00		590.09	589.29	18.00	7	SS	SS	2
MW4-00		590.67	589.65	19.00	7	SS	SS	2
MW5-00		589.73	588.89	13.00	7	SS	SS	2

TABLE 2.2

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Investigation Activity	*Sample Matrix*	*Field Parameters*	*Laboratory Parameters*	*Investigative Samples*	*Quality Control Samples[1]*			*Total*
					Equipment Blanks[2]	*Field Duplicates*	*MS/MSD[3]*	
1. Groundwater Characterization								
Extraction Wells (EW-7, EW-8, EW-9, EW-10, EW-11, EW-12, EW-14)	Water	pH, Temperature, DO, Conductivity, Turbidity	SS-VOC	8	0	1	1	10
Extraction Well Composites [(EW-6, EW-10, EW-12), EW-14, (EW-8, EW-11), (EW-7, EW-9)]	Water	pH, Temperature, DO, Conductivity, Turbidity	SS-SVOC, PCDD/PCDF, PCB, TAL Metals (excluding K), Dissolved Iron, Total Iron Bacteria, Inorganics[4]	4	0	1	1	7
Extraction Wells (EW-7, EW-10, EW-14) Using Extraction Pump and Monitoring Wells MW-1S, MW-300S, MW-100S	Water	pH, Temperature, DO, Conductivity, Turbidity	Dissolved Iron, Total Iron Bacteria, Total Iron	6	0	1	1	8
2. Stormwater Characterization								
Catchbasin 2 (2 different storm events)	Water	pH, Temperature, DO, Conductivity, Turbidity	SS-VOC, SS-SVOC, PCDD/PCDF, PCB, TAL Metals (excluding K), Dissolved Iron, Total Iron Bacteria, Inorganics[4]	2	0	1	1	4

TABLE 2.2

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Investigation Activity	*Sample Matrix*	*Field Parameters*	*Laboratory Parameters*	*Investigative Samples*	*Quality Control Samples*[1] *Equipment Blanks*[2]	*Field Duplicates*	*MS/MSD*[3]	*Total*
3. Surfacewater Characterization								
Saginaw River (approx. 100-feet upstream and 200-feet upstream)	Water	pH, Temperature, DO, Conductivity, Turbidity	SS-VOC, SS-SVOC, PCDD/PCDF, PCB, TAL Metals (excluding K), Dissolved Iron, Total Iron Bacteria, Inorganics[4]	2	0	1	1	4

Notes:

1 Quality control samples will include laboratory supplied trip blank samples for volatile sample analysis with each shipping cooler of aqueous investigative samples.
2 Field blank samples consisting of equipment rinsate blanks will not be collected when dedicated or disposable sampling equipment is employed.
3 Matrix Spike/Matrix Spike duplicate (MS/MSD) analyses are required for samples submitted for organic and inorganic analyses are to be analyzed at a frequency of one per group of twenty (20) or fewer investigative samples for the activities detailed above.
4 Inorganics include the following parameters: Alkalinity, Ammonia-N, Biochemical Oxygen Demand, Chemical Oxygen Demand, Hardness, Hexane Extractable Material, Total Dissolved Solids, Total Organic Carbon, Total Phosphorus, Total Suspended Solids.

TCL - Target Compound List
VOC - Volatile Organic Compounds
PCDD/PCDF = Polychlorinated Dibenzo-p-Dioxin/Polychlorinated Dibenzofuran
SS - Site-specific
SVOC - Semi-volatile Organic Compounds
PCB - Polychlorinated Biphenyls
TAL - Target Analyte List
DO - Dissolved Oxygen

TABLE 6.1

CONTAINER, PRESERVATION, SHIPPING AND PACKAGING REQUIREMENTS
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Analyses	*Sample Containers*	*Preservation*	*Maximum Holding Time from Sample Collection* [1]	*Volume of Sample*	*Shipping*	*Normal Packaging*
SS-VOC	Three 40 mL teflon-lined septum vials per analysis	HCl to pH < 2 Iced, 4 ± 2° C	14 days for analysis	Fill completely, no air bubbles	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
SS-SVOC	Two 1 liter amber glass bottles per analysis	Iced, 4 ± 2° C	7 days for extraction 40 days after extraction for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
PCB	Two 1 liter amber glass bottles per analysis	Iced, 4 ± 2° C	7 days for extraction 40 days after extraction for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
PCDD/PCDF	Two 1 liter amber glass bottles per analysis	Iced, 4 ± 2° C	30 days for extraction 45 days after extraction for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
Metals	One 1 liter plastic bottle	HNO_3 to pH < 2 Iced, 4 ± 2° C	180 days (mercury-28 days) for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
Ammonia	One 250-ml plastic bottle	H_2SO_4 to pH < 2 Iced, 4 ± 2° C	28 days for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Bubble Pack Bubble-wrap
Nitrate	One 250-ml plastic bottle	Iced, 4 ± 2° C	48 hours to start analysis	Fill to neck of bottle	Overnight or Hand Deliver	Bubble Pack Bubble-wrap
TOC	Two 40 ml Teflon-lined septum vials per analysis	H2SO4 to pH < 2 Iced, 4 ± 2° C	28 days for analysis	Fill completely, no air bubbles	Overnight or Hand Deliver	Foam Liner or Bubble-wrap

TABLE 6.1

CONTAINER, PRESERVATION, SHIPPING AND PACKAGING REQUIREMENTS
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Analyses	*Sample Containers*	*Preservation*	*Maximum Holding Time from Sample Collection* [1]	*Volume of Sample*	*Shipping*	*Normal Packaging*
pH	One 250 ml plastic bottle	Iced, 4 ± 2° C	24 hours for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
COD	One 250-ml plastic bottle per analysis	H_2SO_4 to pH < 2 Iced, 4 ± 2° C	28 days for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Bubble Pack Bubble-wrap
BOD	One 1 liter plastic bottle per analysis	Iced, 4 ± 2° C	48 hours to start analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
HEM	One 1 liter amber glass bottle	H2SO4 to pH < 2 Iced, 4 ± 2° C	28 days for analysis	Fill completely, no air bubbles	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
TDS	One 250 ml plastic bottle	Iced, 4 ± 2° C	7 days for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
Total Phosphorus	One 250-ml plastic bottle per analysis	H2SO4 to pH < 2 Iced, 4 ± 2° C	28 days for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
TSS	One 250 ml plastic bottle	Iced, 4 ± 2° C	7 days for analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap
Iron Bacteria	One 125 ml plastic bottle	Iced, 4 ± 2° C	48 hours to start analysis	Fill to neck of bottle	Overnight or Hand Deliver	Foam Liner or Bubble-wrap

Notes:

[1] - These are technical holding times, i.e., are based on time elapsed from time of sample collection.

TABLE 7.1

SUMMARY OF ANALYTICAL METHODS
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Parameter[1]	*Preparation Method*[2]	*Analytical Method*[2]
Site-specific Volatile Organic Compounds (SS-VOC)	SW-846 5030	SW-846 8260
Site-specific Semi-volatile Organic Compounds (SS-SVOC)	SW-846 3500C	SW-846 8270C
Polychlorinated Biphenyls (PCB) as Aroclors	SW-846 3500C	SW-846 8082
Metals		
ICP/MS Metals	SW-846 3010A	SW-846 6020
Mercury	SW-846 7470A	SW-846 7470A
Mercury (Low Level)	EPA 1631E	EPA 1631E
Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans (PCDD/PCDF)	SW-846 8290	SW-846 8290
Alkalinaity	SM 2320B	SM 2320B
Ammonia, Nitrogen	SM 4500 NH3	SM 4500 NH3
Biochemical Oxygen Demand (BOD)	SM 5210B	SM 5210B
Chemical Oxygen Demand (COD)	SM 5220	SM 5220
Hardness (Calculated from Ca and Mg)	SM 2340C	SM 2340C
Hexane Extractable Material (HEM)	EPA 1664	EPA 1664
pH	NA	EPA-WW 150.1
Total Dissolved Solids (TDS)	SM 2540C	SM 2540C
Total Organic Carbon (TOC)	SW-846 9060	SW-846 9060
Total Phosphorus	EPA-WW 365.1	EPA-WW 365.1
Total Suspended Solids (TSS)	SM 2540D	SM 2540D
Total Dissolved Iron	SW-846 3010A	SW-846 6010
Total Iron Bacteria	NA	NA

Notes:

1 Refer to Tables 1.2 for the compounds/elements of each parameter group.

2 Preparation and Analytical Method References:

- SW-846 - "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods ", SW-846, 3rd Edition, and Promulgated Updates, November 1986. Actual method versions employed will include the latest promulgated version of the method adopted by the lab.
- EPA-WW - "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, Revised March 1983.
- ASTM - Annual Book of ASTM Standards, American Society for Testing Materials, Section 5 and Section 11.

NA = Not Applicable

TABLE 7.2

ANALYTICAL PARAMETER LIST
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Compound	*Targeted Quantitation Limits (TQL)* [1] *Water (µg/L)*	*Method Detection Limits (MDL)* [2] *Water (µg/L)*	*Rule 57 Action Levels* *FCV (µg/L)*	*HCVd (µg/L)*	*HNVd (µg/L)*	*WV (µg/L)*
Site-specific Volatile Organic Compounds (SS-VOC)						
Ethylbenzene	1	0.13	18	25	2100	NA
Toluene	1	0.13	270	NA	5600	NA
Vinyl Chloride	1	0.22	930	0.25	83	NA
cis-1,2 dichlorethene	1	0.14	620	NA	880	NA
trans-1,2 dichlorethene	1	0.19	1500	NA	470	NA
Xylenes	3	***0.28***	41	NA	3800	NA
Site-specific Semi-volatile Organic Compounds (SS-SVOC)						
2-Methynapthalene	5	0.1	19	NA	600	NA
Acenapthene	5	0.1	38	NA	580	NA
Bis(2-ethylhex) phthalate	5	0.08	NA	25	120	NA
Carbazole	10	0.28	4	19	NA	NA
Dibenzofuran	4	0.1	4	NA	NA	NA
Fluorene	5	0.1	12	NA	140	NA
Napthalene	5	0.1	11	NA	1100	NA
Phenanthrene	**2**	0.1	1.4	NA	NA	NA
Polychlorinated Biphenyls (PCB) as Aroclors						
Aroclor-1016	0.2	0.044	NA	0.000026	NA	0.00012
Aroclor-1221	0.2	0.05	NA	0.000026	NA	0.00012
Aroclor-1232	0.2	0.1	NA	0.000026	NA	0.00012
Aroclor-1242	0.2	0.060	NA	0.000026	NA	0.00012
Aroclor-1248	0.2	0.061	NA	0.000026	NA	0.00012
Aroclor-1254	0.2	0.032	NA	0.000026	NA	0.00012
Aroclor-1260	0.2	0.038	NA	0.000026	NA	0.00012

TABLE 7.2

ANALYTICAL PARAMETER LIST
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Compound	*Targeted Quantitation Limits (TQL)* [1] *Water (µg/L)*	*Method Detection Limits (MDL)* [2] *Water (µg/L)*	*Rule 57 Action Levels* *FCV (µg/L)*	*HCVd (µg/L)*	*HNVd (µg/L)*	*WV (µg/L)*
TAL Metals						
Aluminum	50	19	NA	NA	NA	NA
Antimony	2	0.13	240	NA	1.7	NA
Arsenic	5	0.4	150	10	10	NA
Barium	100	0.19	437.8	NA	1900	NA
Beryllium	1	0.2	2.39	NA	160	NA
Cadmium	1	0.13	2.52	NA	2.5	NA
Calcium	1000	22	NA	NA	NA	NA
Chromium	5	0.71	74.1	NA	120	NA
Cobalt	7	0.058	100	NA	NA	NA
Copper	2	0.29	8.96	NA	470	NA
Iron	50	26	NA	NA	NA	NA
Lead	3	0.18	37.81	NA	14	NA
Magnesium	1000	17	NA	NA	NA	NA
Manganese	15	0.83	1930	NA	1300	NA
Mercury	0.2	0.12	0.77	NA	0.0018	0.0013
Mercury (Low Level)	0.0005	0.00012	0.77	NA	0.0018	0.0013
Nickel	20	0.2	52.0	NA	2600	NA
Selenium	5	1.2	5	NA	120	NA
Silver	0.2	0.08	0.06	NA	130	NA
Sodium	1000	6.9	NA	NA	NA	NA
Thallium	1	0.14	7.2	NA	1.2	NA
Vanadium	4	0.44	27	NA	53	NA
Zinc	20	2.3	118.1	NA	3300	NA

TABLE 7.2

ANALYTICAL PARAMETER LIST
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Compound	Targeted Quantitation Limits (TQL)[1] Water (µg/L)	Method Detection Limits (MDL)[2] Water (µg/L)	Rule 57 Action Levels FCV (µg/L)	HCVd (µg/L)	HNVd (µg/L)	WV (µg/L)
Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans (PCDD/PCDF)			TEF			
2,3,7,8 - Tetrachlorodibenzo-p-dioxin (TCDD)	1.00E-05	- -[4]	1.0	8.60E-09	6.70E-08	3.10E-09
2,3,7, 8 - Tetrachlorodibenzofuran (TCDF)	1.00E-05	- -	0.1	NA	NA	NA
1,2,3,7,8 - Pentachlorodibenzo-p-dioxin (PeCDD)	5.00E-05	- -	0.5	NA	NA	NA
1,2,3,7,8 - Pentachlorodibenzofuran (PeCDF)	5.00E-05	- -	0.05	NA	NA	NA
2,3,4,7,8 - Pentachlorodibenzofuran (PeCDF)	5.00E-05	- -	0.5	NA	NA	NA
1,2,3,4,7,8 - Hexachlorodibenzo-p-dioxin (HxCDD)	5.00E-05	- -	0.1	NA	NA	NA
1,2,3,6,7,8 - Hexachlorodibenzo-p-dioxin (HxCDD)	5.00E-05	- -	0.1	NA	NA	NA
1,2,3,7,8,9 - Hexachlorodibenzo-p-dioxin (HxCDD)	5.00E-05	- -	0.1	NA	NA	NA
1,2,3,4,7,8 - Hexachlorodibenzofuran (HxCDF)	5.00E-05	- -	0.1	NA	NA	NA
1,2,3,6,7,8 - Hexachlorodibenzofuran (HxCDF)	5.00E-05	- -	0.1	NA	NA	NA
1,2,3,7,8,9 - Hexachlorodibenzofuran (HxCDF)	5.00E-05	- -	0.1	NA	NA	NA
2,3,4,6,7,8 - Hexachlorodibenzofuran (HxCDF)	5.00E-05	- -	0.1	NA	NA	NA
1,2,3,4,6,7,8 - Heptachlorodibenzo-p-dioxin (HpCDD)	5.00E-05	- -	0.01	NA	NA	NA
1,2,3,4,6,7,8 - Heptachlorodibenzofuran (HpCDF)	5.00E-05	- -	0.01	NA	NA	NA
1,2,3,4,7,8,9 - Heptachlorodibenzofuran (HpCDF)	5.00E-05	- -	0.01	NA	NA	NA
Octachlorodibenzo-p-dioxin (OCDD)	1.00E-04	- -	0.001	NA	NA	NA
Octachlorodibenzofuran (OCDF)	1.00E-04	- -	0.001	NA	NA	NA
Additional Parameters						
Alkalinity			NA	NA	NA	NA
Ammonia-N	200	35	29	NA	NA	NA
Biochemical Oxygen Demand (BOD)	2,000	2,000	NA	NA	NA	NA
Chemical Oxygen Demand (COD)	20,000	10,000	NA	NA	NA	NA
Hexane Extractable Material (HEM)	5,000	770	NA	NA	NA	NA

TABLE 7.2

ANALYTICAL PARAMETER LIST
CHARACTERIZATION STUDY OF FORMER GMPT SITE MSA/CSC
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Compound	*Targeted Quantitation Limits (TQL)* [1] *Water (µg/L)*	*Method Detection Limits (MDL)* [2] *Water (µg/L)*	*Rule 57 Action Levels* *FCV (µg/L)*	*HCVd (µg/L)*	*HNVd (µg/L)*	*WV (µg/L)*
Additional Parameters Continued						
Nitrate	100	23	NA	NA	10000	NA
Total Organic Carbon (TOC)	1	0.24	NA	NA	NA	NA
Hardness	5000	3100	NA	NA	NA	NA
Phosphorus	100	33	NA	NA	NA	NA
Total Dissolved Solids (TDS)	10000	7400	NA	NA	NA	NA
Total Suspended Solids (TSS)	4000	1800	NA	NA	NA	NA
Total Iron	50	26	NA	NA	NA	NA
Total Dissolved Iron	50	26	NA	NA	NA	NA
Total Iron Bacteria	NA	NA	NA	NA	NA	NA

Notes:

1 - Please note that these are targeted quantitation limits and are presented for guidance only. Actual quantitation limits are highly matrix dependent and may be elevated due to matrix effects, QA/QC problems and high concentrations of target and non-target analytes.

2 - Method Detection Limits (MDL) are also presented for guidance only. Actual MDLs will vary depending on sample specific preparation factors. The MDLs are also highly matrix dependant and may be elevated due to matrix effects, QA/QC problems and high concentrations of target and non-target analytes. Laboratory MDLs are updated on a periodic basis and the MDLs in effect when the samples are analyzed will be used for reporting purposes.

3 - HCVd = HCV-Human Cancer Value-Drink; FCV = Final Chronic Value
HNVd = Human Noncancer Value-Drink; WV = Wildlife Value

4 - Values in red are based on hardness value of 100 mg/L for northern lower peninsula is used to calculate for this report however the values will be updated upon receipt of actual river hardness

TABLE 9.1

COST ESTIMATE
FOR MSA AND CSC GROUNDWATER AND STORMWATER CHARACTERIZATION
RACER TRUST FACILITY
BAY CITY, MICHIGAN

Item	*Quantity*	*RACER Discounted Unit*	*Rate*	*Cost Estimate*
MSA and CSC Water Characterization				
Project Manager	20	hour	$127.04	$2,540.80
Project Engineer	40	hour	$85.69	$3,427.60
Field Technicians	120	hour	$85.69	$10,282.80
Analytical Cost	1	lump sum	$20,000.00	$20,000.00
Chemist (lab contracting/coordination/validation)	30	hour	$98.09	$2,942.70
Database	10	hour	$69.15	$691.50
Word Processing	10	hour	$48.48	$484.80
Drafting	10	hour	$77.42	$774.20
Disbursements (copies, Fed-ex, phone, field supplies, etc.)	1	lump sum	$5,000.00	$5,000.00
Sub-Consultant	1	lump sum	$5,000.00	$5,000.00
			Subtotal	$51,144.40
			TOTAL COST ESTIMATE (Rounded)	$51,150

Notes:

Professional fees are based on the 2009 CRA fee schedule with a 17.31% discount + $3 for IT for RACER projects
Does not include pilot study costs

APPENDIX A

PUMPING TEST – DRAW DOWN DATA (FORM SP-20) AND RECOVERY DATA (FORM SP-21)

PUMPING TEST - DRAWDOWN DATA

Well No.: ____________________

Project No.: ____________ Project Name: ____________

Date: ____________ Type of Test: ____________

CRA Supervisor: ____________ Pump Setting: ____________ amsl

Pumped Well No.: ____________

Screened Interval: ____________ to ____________ Pumping Rate (Q): ____________

Aquifer Thickness: ____________ Datum Point: ____________ Datum Point Elevation: ____________ amsl

Static Water Level: ____________ ☐ Confined ☐ Unconfined

Time			*Elapsed Time (min.)*	*Water Level*	*Drawdown*	*Q*	*Remarks*
Day	*Hr.*	*Min.*					

PUMPING TEST - RECOVERY DATA

Pumped Well No.: ______________________

Project No.: ____________________ Project Name: ____

Date: ____________________ Type of Test: ____

CRA Supervisor: ____ Pump Setting: ____________ amsl

Pumped Well No.: ____

Screened Interval: ________________ to ____________________ Pumping Rate (Q): ____________________

Aquifer Thickness: ____________ Datum Point: ______________ Datum Point Elevation: ____________ amsl

Static Water Level: ____________ ☐ Confined ☐ Unconfined

Time			***Time (t) Since Pumping Stopped (min.)***	***Ratio t/t'***	***Water Level***	***Residual Drawdown***	***Remarks***
Day	***Hr.***	***Min.***					

APPENDIX B

TYPICAL CHAIN-OF-CUSTODY FORM

CHAIN OF CUSTODY RECORD

CRA
CONESTOGA–ROVERS & ASSOCIATES
651 Colby Drive
Waterloo, Ont. N2V 1C2 (519)884–0510

SHIPPED TO (Laboratory Name): ABC Laboratories, 123 Analytical Lane, Waterloo, ON N2V 1V3

REFERENCE NUMBER: 43210

SAMPLER'S SIGNATURE: John Doe PRINTED NAME: John Doe

SEQ. No.	DATE	TIME	SAMPLE No.	SAMPLE TYPE	No. OF CONTAINERS	VOCs	PCBs	Cu, Fe	REMARKS
1	03/20/08	9:10am	GW-43210-JWD-032008-001	Groundwater	3	X			5 day turnaround time.
2	03/20/08	10:00am	GW-43210-JWD-032008-002	Groundwater	5	X	X	X	Please contact CRA
3	03/20/08	11:30am	GW-43210-JWD-032008-003	Groundwater	5	X	X	X	chemist indicated on SSOW/PO# 20-001234
4	03/20/08	12:00pm	S-43210-JWD-032008-001	Soil	2	X			with any questions.
5	03/20/08	1:00pm	S-43210-JWD-032008-002	Soil	2	X			Criteria – Reg 153/04 Table 2
6	—	—	Trip Blank	Water	3	X			
									Groundwater samples have been field filtered for Cu & Fe.

TOTAL NUMBER OF CONTAINERS: 20 HEALTH/CHEMICAL HAZARDS: unknown

RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	DATE / TIME
① John Doe	DATE: 03/20/08 TIME: 4:30pm	②	DATE: TIME:
②	DATE: TIME:	③	DATE: TIME:
③	DATE: TIME:	④	DATE: TIME:

METHOD OF SHIPMENT: Fedex WAY BILL No. 7595684773

White –Fully Executed Copy
Yellow –Receiving Laboratory Copy
Pink –Shipper Copy
Goldenrod –Sampler Copy

SAMPLE TEAM: John Doe, Joe Smith

RECEIVED FOR LABORATORY BY:

DATE: TIME:

[redacted] Nº 24365

1001 (D) SEPT 28/93(W) REV.0 (F–42)

figure 3.15

TYPICAL COMPLETED CHAIN-OF-CUSTUDY FORM